Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2020-1069-RC1, 2021

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Future evolution of aerosols and implications for climate change in the Euro-Mediterranean region" *by* Thomas Drugé et al.

Anonymous Referee #1

Received and published: 4 January 2021

This manuscript investigates the near future evolution of aerosols and their implications for climate change in the Euro-Mediterranean using a regional climate model. It is a very interesting study showing original results while it is generally well written and presented. I suggest acceptance of the manuscript for publication but I have a number of comments that have to be addressed before the final acceptance.

Comments

1) Page 1, lines 13-15: Maybe it would be to mention in the abstract what is the range of sulfate and nitrate and ammonium DRF for the different scenarios. 2) Page 2, lines 21-25: Besides the advantages of resolution to study aerosol-climate inter-

Printer-friendly version

Discussion paper

actions with RCMs, it is also important to mention the limitations in comparison to Earth System Models (ESMs). For example, can the regional model domain setup account a) for the slow climate responses to aerosols and b) the influence of remote forcings of aerosols simulated in global models? Are the climate responses due to aerosols in RCMs more comparable with the fast responses simulated in ESMs when SSTs are prescribed? 3) Page 3, lines 5-7: A reference could be added here. 4) Page 3, lines 33-35: This is an important point as there is limited number of RCM studies that account for aerosol-cloud interactions. See for example a recent study by Pavlidis et al. (https://doi.org/10.5194/gmd-13-2511-2020). 5) Page 5, lines 20-22: I am rather confused. What about the ammonium and nitrate aerosol precursors in the future simulations? Is it based again on CAMS climatology? Please clarify accordingly within the manuscript. 6) Page 6, lines 9-10: This is further supported from the fact that non-methane mitigation of short-lived climate forcers leads to a net warming effect in the near-term due to the removal of aerosol (see e.g. Allen et al., 2020, https://doi.org/10.5194/acp-20-9641-2020). 7) Page 8, lines7: Figure 4 shows the CNRM-ALADIN63 AOD results. How that compares with CNRM-ESM2-1 as both share the same physics and same forcings and include the TACTIC aerosol scheme (except nitrate and ammonium particles that are only used in CNRM-ALADIN63). The authors make already a comparison between the RCM and the driving ESM for cloud cover in Figure A2 but maybe a comparison for AOD and SW direct RF would be also useful. 8) Page 8, lines 9-12: It would be useful to add a sentence on how the modelled aerosol contributions to AOD over the historical period in Figure 5 compare with observational studies based on satellite data. For example despite the different periods, I see a reasonable consistency with contribution of different aerosol types to the aerosol optical depth based on MODIS over Mediterranean in Figure 7 by Gergoulias et al.(doi:10.5194/acp-16-13853-2016). 9) Page 8, lines 23-25: Over Mediterranean, at least in surface concentration for a few months, it seems there are some important contributions from dust and sea salt changes under SSPs (Figure 5). Also in AOD there are small but notable changes due to dust changes under SSPs in a few months.

10) Page 10, lines 5-6: So maybe you can specify that this is an instantaneous radiative forcing. 11) Page 10, line 1: The authors give emphasis on the direct radiative forcing but skip the cloud radiative forcing and the forcing due to semi-direct effects. Could they justify why not discussing them? 12) Page 12, lines 3-5: Please be more specific for which months and scenario. 13) Page 14, lines 10: Please can you discuss quantitatively what is well correlated? 14) Page 14, lines 19-21: The authors discuss the impact of cloud optical depth on surface sola radiation. However, I was wondering why not calculating and discussing a cloud RF. 15) Page 14, lines 32: Maybe in order to strengthen the possibility that atmospheric dynamics contributes to surface solar radiation increase it would be nice to look also circulation changes (e.g. mslp changes). Maybe there is an anticyclonic circulation anomaly, Cloud cover itself in Figure 14c is not so straightforward indicator. Also the cloud cover decrease over Iberian Peninsula is related to the decrease of COD. 16) Page 15, lines 7: Maybe you have to check if there is present an anticyclonic circulation anomaly that plays a role on what is shown in Figure 16.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-1069, 2020.

Printer-friendly version

Discussion paper